METHOD AND SYSTEM FOR OUT-OF-BAND MESSAGING BETWEEN CUSTOMER PREMISES EQUIPMENT AND A CABLE MODEM TERMINATION STATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional application Serial No. 60/501,231 filed September 5, 2003.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to Customer Premises Equipment (CPE) for operation with a Cable Modem Termination System (CMTS) of a cable system.

2. Background Art

Customer Premises Equipment (CPE) generally refer to items at a subscriber station that are configured to receiving cable signals, including video and control signals, from a cable service provider. The control signals, which are typically transmitted as Out-Of-Band (OOB) signals, are transferred from a management network to the subscriber station through a Cable Modem Termination System (CMTS) of a cable network. The CPE converts the OOB signals to control, application, and configuration signals for providing cable services to a subscriber station.

A need exists for a method and system for OOB messaging CPE and a CMTS.

SUMMARY OF THE INVENTION

One aspect of the present invention relates to Customer Premises Equipment (CPE) for operation with a Cable Modem Termination System (CMTS) configured to output out-of-band (OOB) messages and downstream channel

descriptor (DCD) messages over a cable network. The OOB messages are preferably outputted over one or more one-way data tunnels, each data tunnel being identified with a network address. The DCD messages are preferably outputted over downstream channels and identify at least a portion of the network addresses associated with the tunnels provided by the CMTS.

The CPE preferably includes an embedded settop box (eSTB), an embedded cable modem (eCM), and optionally, a conditional access (CA) unit, which can be integrated with the eSTB and/or a separate feature, such as a CableCard or SmartCard. The eCM preferably scans the downstream channels for the CMTS to locate a channel having a DCD message. It interrogates the DCD message channel to determine the DCD message identifier included therewith. The DCD message identifier is then compared to a CPE identifier to determine if they match. If the DCD message identifier matches the CPE identifier it is a matching DCD message and the tunnels identified by the network address therewith are tuned to by the eCM and the data streams associated therewith are transferred to the eSTB.

In accordance with one aspect of the present invention, the determination of whether the DCD message includes a matching identifier is performed by the eCM based on the CPE identifier being outputted thereto by the eSTB or the CA unit. In accordance with one aspect of the present invention, the determination as to whether the DCD message includes a matching identifier is performed by the eSTB based on the CPE identifier being embedded therein or outputted thereto by the CA unit, in which case the eCM outputs the DCD message identifier to the eSTB for the comparison. In accordance with another aspect of the present invention, the determination of whether the DCD message includes a matching identifier is performed by the CA unit based on the CPE identifier being embedded therein or outputted thereto by the eSTB, in which case the eCM outputs the DCD message identifier directly to the CA unit or to the CA unit by way of the eSTB for the comparison.

In accordance with one aspect of the present invention, the eCM remains tuned to the tunnels identified in the matched DCD message if an interrupt

occurs in the data tunnels. Preferably, the eCM remains tuned to the tunnels as long as the matched DCD message is being received by the eCM. If the matched DCD message is lost and/or if the DCD message is changed such that it no longer includes a matching DCD identifier, the eCM begins re-scanning the downstream channels to locate another matching DCD message.

The above features and advantages, along with other features and advantages of the present invention, are readily apparent from the following detailed description of the invention when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 illustrates a cable system in accordance with one aspect of the present invention;

FIGURE 2 illustrates Customer Premises Equipment (CPE) in accordance with one aspect of the present invention;

FIGURE 3 illustrates a flowchart of a method for Out-Of-Band (OOB) messaging in accordance with one aspect of the present invention; and

FIGURE 4 illustrates a diagram of a Downstream Channel Descriptor (DCD) message in accordance with one aspect of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

FIGURE 1 illustrates a cable system 10 in accordance with one aspect of the present invention. The system 10 includes a management network 12 and a High Speed Data (HSD) network 14 that respectively provide management and HSD services over a hybrid fiber coax (HFC) 18, or other communication medium, to a subscriber station 20, which includes Customer Premises Equipment (CPE) 22 and a cable modem (CM) 24.

The management network 12 generally comprises two portions, a control portion 30 and an application portion 32. The control portion 30 includes a settop box (STB) controller to control, provision, manage, and secure the CPE 22 through out-of-band (OOB) messaging. The application portion 32 provides applications to the CPE 22, such as video on demand (VOD), interactive television (iTV), and other services.

The HSD network 14 provides data services for the system 10, including services for the CM 24 to access the Internet 36. It includes a network provisioning unit (NPU) 38 having capabilities for Dynamic Host Configuration Protocol (DHCP), Trivial File Transfer Protocol (TFTP), and the like, in addition to a Domain Name System (DNS) server.

The system 10 includes a cable modem termination system (CMTS) 42 to send and receive signals to and from the CPE 22 and the CM 24 over the HFC 18. In general, the CMTS 42 transfers IP packets from the HSD network 14 and the management network 12 to the CPE 22 and CM 24 for processing. Preferably, the signals are outputted from the CMTS 42 on downstream output channels, which preferably include one-way output data tunnels, such as for OOB messaging. In addition, the CMTS 42 is configured to receive signals from the CPE 22 and the CM 24 to support two-way communication therewith, such as for transfer of IP packets from the CPE 22 and/or the CM 24 to the Internet 36 and/or the VOD or STB controller portions 32 and 30.

The system 10 includes a conditional access router (CAR) 46 to connect the management network 12 to the CMTS 42. The CAR 46 transports signals therebetween using IP protocols and provides firewall separation for the VOD or STB controller portions 32 and 30 from the HSD network 14, enhancing security from any devices attempting to associate with devices and signaling on the management network 12. In operation, signaling traffic transported between the management network 12 and the CMTS 42 may be wrapped into addressable packets, such as Ethernet, IP, or other packets.

The system 10 includes a video unit 50 for delivering video signals to the subscriber station 20 over the HFC 18. The video unit 50 can deliver any number of video signals, including network television, cable television, pay-per-view, video on demand, and the like.

FIGURE 2 illustrates the CPE 22 in accordance with one aspect of the present invention. The CPE 22 is preferably configured to communicate with the CMTS 42 through digital cable signals, such as through signaling defined by the Data Over Cable Service Interface Specification (DOCSIS) and/or through other protocols authorized through DHCP registration.

The CPE 22 includes a radio frequency (RF) splitter 60, an embedded cable modem (eCM) 62, an embedded set-top box (eSTB) 64, an audio visual (A/V) port 66, and an optional conditional access (CA) unit 68. The RF splitter 60 splits the RF signal into two portions - one for OOB control functions and two-way application traffic and one for video delivery. The OOB and two-way application traffic is relayed to the eCM 62 and the video is relayed to the eSTB 64.

The eSTB 64 outputs video and other media signals to a media output device (not shown) or other device connected to the A/V port 66, such as to a television (TV), digital video recorder (DVR), personal video recorder (PVR), or the like.

The eCM 62 processes control and other non-media signals, such as DOCSIS and other IP packets, and bridges or relays the signals to the eSTB 64 through an internal communications link 70. In particular, the communications link 70 is used to transfer data tunnels tuned to by the eCM 62 to the eSTB 64 so that OOB messaging signals can be delivered to the eSTB 64 for processing.

The CA unit 68 provides conditional access control for the subscriber station 20. It can be a CableCard, SmartCard, or other item for controlling security and access to the data, video, and control signals transmitted over the HFC 18. It

is illustrated as a standalone item, however, it can be included with or embedded on the eSTB 64 or the eCM 62 to perform similar functions.

The eCM 62, eSTB 64, and CA unit 68 are logically separate entities, however, they may physically share hardware and software. Other items, such as control logic and applications may be included on the CPE 22 for controlling operation of the eSTB 64 and/or the eCM 62.

FIGURE 3 illustrates a flowchart 80 of a method for OOB messaging in accordance with one aspect of the present invention.

Block 84 relates to outputting OOB messages from the CMTS 42 to one or more CPEs 22 connected to the HFC 18. In particular, the OOB messages are output over one-way data tunnels (not shown) of the CMTS 42. Each tunnel is associated with a network address 92 (see Fig. 4), such as a media access control (MAC) address so that the CPE 22, and in particular, the eCM 62 can tune to desired tunnels based on the MAC addresses.

Block 86 relates to outputting DCD messages 88 (see Fig. 4) from the CMTS 42 to one or more CPEs 20 connected to the HFC 18. In particular, the DCD messages 88 are outputted over downstream channels of the CMTS 42. Each DCD message 88 is outputted on separate channels and identifies at least a portion of the network address 92 associated with the data tunnels.

FIGURE 4 illustrates a diagram of the DCD message 88 in accordance with one aspect of the present invention. The illustrated DCD message 88 is in a table format, however, the message may have any form. It includes a tunnel type column 90, a network address column 92, and a tunnel identifier column 94. The tunnel type column 90 identifies the tunnel types of the tunnels identified in the DCD message 88. The network address 92 associated with the tunnel types 90 are shown in the network address column 92. Tunnel identifiers 94 associated with the network address are shown in the tunnel identifier column 94. The tunnel identifiers 94 are unique identifiers associated with each tunnel type 90. The tunnel

types are common identifiers, i.e. broadcast, conditional access, application, etc., such that the same DCD message 88 or different DCD message 88 may include the same tunnel type. In contrast, the tunnel identifier 96 is a unique identifier for each tunnel, regardless of the tunnel type 90 assigned to the tunnel, such that the tunnel identifier 96 may be used to differentiate between different tunnels identified with the same tunnel type 90. For example, the CMTS 42 may be required to support CPEs 22 of different vendors such that each vendor requires a particular set of conditional access signals. In this case, the conditional access signals are provided through different conditional access tunnels, whereby each conditional access tunnel is identifiable by the tunnel identifier 96 associated therewith. In this manner, multiple conditional access tunnels can be used within the system 10 and assigned to different CA units 68 based on the unique tunnel identifier 96, which is preferably referred to as its conditional access identification.

Returning to Figure 2, block 98 relates to scanning downstream channels of the CMTS 42 for DCD messages 88. Multiple channels are analyzed to determine whether they include a DCD message 88. In some case, the scanning of the channels may include scanning video channels, DOCSIS channels, and non-DOCSIS channels. Preferably, the DCD message 88 is included on a DOCSIS management layer channel such that all non-DOCSIS channels are discarded so scanning may continue.

Block 100 relates to interrogating the DCD messages 88 to determine if a DCD message identifier included therewith matches a CPE identifier. This can be done with the eCM 62, the eSTB 64, and/or the CA unit 68. The DCD message identifier is preferably any identifier that can be used to reference the DCD message 88, including one of the values included in the DCD message 88, such as the tunnel identifiers. The CPE 22 identifier is an identifier embedded or programmed into the eSTB 64, the eCM 62, and/or the CA unit 68. The system 10 may include CPEs 22 manufactured by any number of vendors, and the CPE identifier is preferably associated with the vendor. Preferably, the CPE identifier is the tunnel identifier 96 of the conditional access tunnel supported by the vendor. This is advantageous

because the eSTB 64 can only operate if it receives instructions through the conditional access tunnel that corresponds with its vendor configuration.

Block 102 relates to tuning to the tunnels identified in the DCD message 88. In particular, the tuning is performed by the eCM 62 accepting data streams based on the network address 92 in the DCD message 88 and delivering the data stream to the eSTB 64. The eCM 62 can automatically tune to tunnels based on the matching DCD message 88 and/or it can be instructed by the eSTB 64 or the CA unit 68, depending on the item interrogating the DCD message 88 in block 100.

Block 104 relates to remaining tuned to the tunnels of block 102 during tunnel interrupts. Tunnel interrupts cover any interrupt in the supply of data through the tunnels, such as temporary power losses or shorts, maintenance interrupts, and the like. Preferably, the eCM 62 stays tuned to the tunnels as long as the DCD message identifying the tunnels is being received. If the DCD message 88 is lost, then the eCM 64 begins searching for another DCD message 88, which is common if it is desirable to change the tunnels tuned to by the eCM 62, wherein the DCD message 88 is simply retracted and a new DCD message 88 with new network addresses 92 for the tunnels is outputted.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.